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FEATURES OF IMPLEMENTATION OF CARDIOVASCULAR SYSTEM PATHOLOGY IN CHILDREN WITH OBESITY, IMPROVEMENT OF PREVENTION AND TREATMENT

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ANNOTATION.

58 children with obesity and arterial hypertension were examined. It was revealed that the development of myocardial hypertrophy is influenced by body weight, blood pressure level, vasoconstriction processes, as well as insulin resistance and atherogenic dyslipidemia. These parameters can serve as early markers of myocardial hypertrophy. Also, in children with obesity and hypertension, complete metabolic syndrome was detected in 1/5 cases and incomplete metabolic syndrome in 1/3 cases, which requires immediate treatment of this condition to prevent early complications and disability of adolescents in adulthood.

Key words: obesity; abdominal obesity; arterial hypertension; risk factors; children and teenagers.

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ОСОБЕННОСТИ РЕАЛИЗАЦИИ ПАТОЛОГИИ СЕРДЕЧНО-СОСУДИСТОЙ СИСТЕМЫ У ДЕТЕЙ С ОЖИРЕНИЕМ, СОВЕРШЕНСТВОВАНИЕ ПРОФИЛАКТИКИ И ЛЕЧЕНИЯ

АННОТАЦИЯ

Обследовано 58 ребенка с ожирением и артериальной гипертензией. Выявлено, что на развитие гипертрофии миокарда влияют, масса тела, уровень АД, процессы вазоконстрикции, а также инсулинорезистентность и атерогенная дислипидемия. Эти параметры могут служить ранними маркерами гипертрофии миокарда. Также у детей с ожирением и АГ в 1/5 случаев выявлен полный метаболический синдром и в 1/3 случаев неполный метаболический синдром, что требует незамедлительной терапии данного состояния, для предотвращения ранних осложнений и инвалидизации подростков во взрослом периоде.

Ключевые слова: ожирение; абдоминальное ожирение; артериальная гипертензия; факторы риска; дети и подростки

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SEMIZLIK BILAN OG'RIGAN BOLALARDA YURAK-QON TOMIR TIZIMI PATOLOGIYASINI O`ZIGA XOS KECHISH XUSUSIYATLARI

ANNOTATSIYA

Semizlik va arterial gipertenziya bilan kasallangan 58 nafar bola tekshirildi. Miyokard gipertrofiyasining rivojlanishiga tana vazni, qon bosimi darajasi, vazokonstriksiya jarayonlari, shuningdek, insulin qarshiligi va aterogen dislipidemiya ta'sir qilishi aniqlandi. Ushbu parametrlar miyokard gipertrofiyasining dastlabki belgilari bo'lib xizmat qilishi mumkin. Shuningdek, semizlik va gipertoniya bilan og'rigan bolalarda 1/5 holatda to'liq metabolik sindrom va 1/3 holatda to'liq bo'lmagan metabolik sindrom aniqlangan, bu esa o'smirlarning katta yoshdagi erta asoratlari va nogironligini oldini olish uchun ushbu holatni zudlik bilan davolashni talab qiladi.

Kalit so'zlar: semizlik; abdominal semirish; arterial gipertenziya; xavf omillari; bolalar va o'smirlar

Relevance of the problem. Recent data prove that left ventricular hypertrophy is an independent risk factor for the development of cardiovascular diseases and mortality in adults [2,6]. According to the authors, the formation of eccentric LVH occurs earlier in children with borderline arterial hypertension against a background of obesity [1,2], and there are also studies confirming the earliest development of signs of left ventricular remodeling in patients with obesity and insulin resistance [3,5].

Materials and methods: 58 children aged 15 to 18 years with exogenous constitutional obesity were examined. The criterion for selecting patients was the determination of BMI and waist circumference in children and adolescents with identified overweight and/or obesity, which was above the 97th percentile for a certain age and gender (WHO 2006). The study included 28 girls (46%) and 33 (54%) boys, with an average age of 17.01 ± 0.21 years. The groups were divided based on BMI. Group 1 consisted of 23 teenagers with overweight and obesity of the 1st degree (30.2±1.3 kg/m2), group 2 consisted of 20 teenagers and BMI - 33.4±1.1 kg/m2. Group 3 included 18 adolescents with a BMI of 36.1±1.4 kg/m2. The control group consisted of 20 healthy adolescents of the same age with a BMI of 22.5±0.9 kg/m2. The study was carried out through a general clinical standard examination. Body weight was assessed using percentile tables of the ratio of linear height to body weight or body mass index (Quetelet index) for a specific age and sex (WHO, 1998). The waist (WC) and hip (HC) volumes were determined, the ratio of which is an indicator of abdominal obesity. When WC/TB values were >0.85 in girls and >0.9 in boys, their condition was classified as abdominal obesity (IDF, 1997). Arterial hypertension was diagnosed in accordance with the criteria developed by the Expert Committee of the All-Russian Scientific Society of Cardiologists and the Association of Pediatric Cardiologists of Russia (Moscow, 2009) [4]. Morphometric indices of the myocardium (myocardial mass - LVMM, myocardial mass index - LVMI, thickness of the interventricular septum - IVSD, thickness of the posterior wall of the left ventricle - LVPT) were assessed by ultrasound echocardiography on an Aloka Alpha-7 ultrasound scanner with a cardiology package. Laboratory testing included determination of serum cholesterol, high-density lipoprotein and triglyceride levels using a biochemical analyzer. Serum insulin levels were determined by enzyme immunoassay. Insulin resistance was assessed using the HOMAR index, which reflects the ratio of glucose (in mg/dL) and insulin (in μIU/ml). The criterion for the presence of IR was considered to be an index value above 2.7 conventional units. Results of the study: in accordance with our goal, we determined the relationship between the degree of BMI and the level of systolic and diastolic pressure in adolescents.

The results of the study showed that the level of systolic and diastolic blood pressure for all time periods was significantly higher in adolescents of group 3 (135.2 ± 9.1 mm Hg, $p < 0.05$ and $p < 0.05$) compared to values of adolescents with grade 1 and 2 obesity (118.3±7.5 and 123.2±6.7 mmHg) At the same time, a direct correlation between BMI and systolic pressure, diastolic pressure and average pressure per day ($r = 0.602$; $r = 589$ and $r = 0.603$, respectively, $p < 0.01$ for all indicators). It should be noted that according to the results of a study of blood pressure among adolescents with overweight and obesity, “white coat hypertension” was detected in 22.9% of cases, a labile form of hypertension in 16.3%, and a stable form of hypertension in 13.1%. At the same time, the stable form was significantly more often detected in grade 3 obesity (6.5%) compared with grade 1 obesity and grade 2 obesity (3.2% and 3.2%, respectively). An echocardiographic study showed that with obesity in combination with arterial hypertension, a structural and geometric restructuring of the left ventricular myocardium occurs. In this case, first of all, the wall thickness increases. We found a statistically significant relationship between BMI and the thickness of the posterior wall of the left ventricle ($r = 0.588$; $p < 0.05$). It should be noted that hypertrophy of the walls of the left ventricle is formed initially as an adaptive response of the myocardium to pressure load and ensures that the contractile function of the left ventricle corresponds to the increased load. The main indicators characterizing left ventricular myocardial hypertrophy are myocardial mass and left ventricular myocardial mass index. Our data showed that the incidence of left ventricular hypertrophy was 43.4% in group 1, 50% in group 2, and 61.1% in group 3. At the same time, when analyzing the left ventricular myocardial mass index depending on the type of arterial hypertension, no significant differences were found. For white coat hypertension - 35.7±3.4 g/m2.7, for labile hypertension - 35.9±4.7 g/m2.7, and for stable hypertension - 36.4±4.6 g/m2, 7. This fact suggests that it is obesity that makes a significant contribution to the degree of increase in left ventricular mass. Restructuring of the geometry of the left ventricle was detected in almost 1/3 of obese adolescents, with 30.4% in group 1, 35.0% in group 2 and 33.3% in group 3. Eccentric left ventricular hypertrophy was diagnosed in 16.3% of patients, concentric remodeling in 11.4%. It should be noted that concentric hypertrophy of the left ventricle is associated with the maximum risk of cardiovascular complications; in our studies, it occurred in 4.9% of cases and only in the group of adolescents with grade 3 obesity. Structurally, the geometric restructuring included a change in the geometry of not only the left ventricle, but also the left atrium. Thus, a difference in the average values of the size of the left atrium was detected between all observation groups (31.4 ± 1.2 mm; 31.8 ± 0.8 mm and 34.5 ± 1.4 mm in groups 1, 2 and 3, respectively). The correlation between the dimensions of the left atrium and BMI was also statistically significant ($r = 0.608$; $p < 0.01$). Most likely, changes in the structure of the left atrium are the earliest stage of myocardial

remodeling. The compensatory reaction of the cardiovascular system in response to obesity also affected central hemodynamics. This changed the volume of circulating blood and the total peripheral vascular resistance. Minute blood volume gradually increased as obesity progressed (5.5±1.1 l/min, 5.8±0.9 l/min and 6.2±1.1 l/min, respectively, in groups 1, 2 and 3) , which indirectly indicates an increase in the volume of circulating blood. The increase in minute volume was accompanied by a decrease in total peripheral vascular resistance as body weight increased (1318.8±289.1 dynes/cm/s-5; 1299.9±274.3 dynes/cm/s-5 and 1287.4±284 .1 dyn/cm/s-5, respectively, in groups 1, 2 and 3) Also, the total peripheral resistance depended on the type of arterial hypertension, so in labile arterial hypertension this figure was 1287.8±250.7 dyn/cm/s-5 , and at a stable 1325.6±301.5 dynes/cm/s-5, which characterized the depletion of the body's adaptive capabilities and an increase in total peripheral vascular resistance. It was also of interest to us to study the state of lipid and carbohydrate metabolism, the disruption of which sharply increases the risk of atherogenic changes in the vascular wall. To determine the type of carbohydrate metabolism disorder, a glucose tolerance test was conducted, which revealed disorders in 22.9% of adolescents, mainly in groups 2 and 3 (30% and 44.4%). But even the glucose tolerance test does not always reflect the degree of carbohydrate metabolism disorder, and therefore we studied the level of immunoreactive insulin in the blood with the subsequent determination of the HOMA R index. The results of the study showed that the level of immunoreactive insulin was statistically significantly higher in obese children (14.2±1.2 μIU/ml; 16.7±1.5 μIU/ml; 19.3±2.1 μIU/ml; in 1, 2 and 3 groups, respectively) compared to the control group (9.3±0.8 μIU/ml), with normal fasting glucose levels. The incidence of insulin resistance in obese patients was 24.5%. As obesity progressed, the incidence of insulin resistance increased. Thus, in group 1, insulin resistance was detected in 13.0%, in group 2 in 25%, and in group 3 in 38.8% of cases. Correlation analysis revealed direct connections between the level of immunoreactive insulin and BMI ($r=0.545$; $p<0.01$), as well as a relationship between BMI and the HOMA index ($r=0.704$; $p<0.01$). The findings suggest that insulin levels are directly and significantly related to excess fat accumulation. When comparing insulin resistance and the form of arterial hypertension, it was found that in adolescents with white coat hypertension, insulin resistance was diagnosed in 3.2%, in adolescents with labile hypertension in 8.1%, and in children with stable hypertension in 11.4% of cases. This proves that insulin resistance is a key mechanism around which a chain of hemodynamic and metabolic pathologies is formed. When analyzing the results of the lipid composition of the serum of the studied cohort of adolescents, it was revealed that as obesity progressed, both the level of triglycerides ($r=0.621$; $p<0.01$) and the level of low-density lipoproteins ($r=0.501$; $p<0.05$) increased. , and the level of high-density lipoproteins decreased ($r=0.703$; $p<0.001$).

Thus, the data obtained show that the presence of dyslipidemia against the background of insulin resistance, accompanied by hypertension and obesity, indicates the formation of a complete metabolic syndrome in this cohort of adolescents, which in our studies was identified in 19.6% of cases; incomplete metabolic syndrome was diagnosed 36.0% of cases.

Conclusions: the development of myocardial hypertrophy is influenced by body weight, blood pressure levels, vasoconstriction processes, as well as insulin resistance and atherogenic dyslipidemia. These parameters can serve as early markers of myocardial hypertrophy. Also, in children with obesity and hypertension, complete metabolic syndrome was detected in 1/5 cases and incomplete metabolic syndrome in 1/3 cases, which requires immediate treatment of this condition to prevent early complications and disability of adolescents in adulthood.

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